

IN THE CLAIMS:

Claims 1 – 32 (canceled)

Claim 33 (previously presented) A digital subscriber line communicating system for communicating between a transmitting side and a receiving side through a communication line, comprising:

a sliding window generating unit for generating a sliding window based on a timing signal representing a periodical noise duration; and

a sliding window transmitting unit for transmitting a modulated symbol according to said sliding window through said communication line to said receiving side;

wherein said transmitting side is a central office and said receiving side is a remote terminal;

said central office comprising:

a timing signal generating unit for generating said timing signal synchronized with a transmission system which interfaces said central office and said remote terminal;

said sliding window generating unit being operatively connected to said timing signal generating unit, and said sliding window being a downstream sliding window indicating the phase of a noise condition of said remote terminal; and

said sliding window transmitting unit transmitting modulated symbols according to said downstream sliding window through said communication line to said remote terminal; and

said remote terminal comprising:

a sliding window receiving unit for receiving modulated symbols according to said downstream sliding window from said central office;

said downstream sliding window indicating cross-talk durations due to TCM ISDN transmission at the remote terminal;

wherein a first cross-talk duration is within a prior half of each cycle of said timing signal, and a second cross talk determined with a near end cross-talk duration at the remote terminal, is within a latter half of each cycle of said timing signal,

an inside of said downstream sliding window being formed within said first cross-talk duration;

and wherein, during timing recover training between said central office and said remote terminal, an inside symbol of said downstream sliding window is formed by a first kind of signal, and an outside symbol of said downstream sliding window is formed by a second kind of signal, said first kind of signal and said second kind of signal being obtained by modulating a carrier signal but being different in phase by a predetermined angle.

Claim 34 (previously presented) A digital subscriber line communicating system for communicating between a transmitting side and a receiving side through a communication line, comprising:

a sliding window generating unit for generating a sliding window based on a timing signal representing a periodical noise duration; and

a sliding window transmitting unit for transmitting a modulated symbol according to said sliding window through said communication line to said receiving side;

wherein said transmitting side is a central office and said receiving side is a remote terminal;

said central office comprising:

a timing signal generating unit for generating said timing signal synchronized with a transmission system which interfaces said central office and said remote terminal;

said sliding window generating unit being operatively connected to said timing signal generating unit, and said sliding window being a downstream sliding window indicating the phase of a noise condition of said remote terminal; and

said sliding window transmitting unit transmitting modulated symbols according to said downstream sliding window through said communication line to said remote terminal; and

said remote terminal comprising:

a sliding window receiving unit for receiving modulated symbols according to said downstream sliding window from said central office;

said downstream sliding window indicating cross-talk durations due to TCM ISDN transmission at the remote terminal;

wherein said downstream sliding window is generated in such a way that an inside symbol of said downstream sliding window is received by said remote terminal in a first cross-talk duration determined with a far end cross-talk duration at said remote terminal;

and wherein when a first modulated symbol is synchronized with the head of one cycle of said timing signal, said central office comprises a duration discriminating unit for discriminating whether an N-th symbol belongs to an inside or an outside of said downstream sliding window.

Claim 35 (previously presented) A digital subscriber line communicating system for communicating between a transmitting side and a receiving side through a communication line, comprising:

a sliding window generating unit for generating a sliding window based on a timing signal representing a periodical noise duration; and

a sliding window transmitting unit for transmitting a modulated symbol according to said sliding window through said communication line to said receiving side;

wherein said transmitting side is a remote terminal and said receiving side is a central office, said remote terminal comprising:

a timing signal receiving unit for receiving a timing phase via a received modulated symbol according to a downstream sliding window from said central office, said timing signal being synchronized with a transmission system which interfaces said central office and said remote terminal;

said sliding window generating unit being operatively connected to said timing signal receiving unit, and said sliding window being an upstream sliding window indicating a phase of noise condition of said central office; and

a sliding window transmitting unit for transmitting modulated symbols according to said upstream sliding window through said communication line to said central office;

said upstream sliding window indicating a cross-talk duration due to TCM ISDN transmission at said central office;

wherein said upstream sliding window is generated in such a way that an inside symbol of said upstream sliding window is received by said central office in a third cross-talk duration determined with a far end cross-talk duration at said central office;

and wherein when the a first modulated symbol is synchronized with the head of one cycle of said timing signal, said remote terminal comprises a duration discriminating unit for discriminating whether an N-th modulated symbol belongs to an inside or an outside of said upstream sliding window.

Claim 36 (previously presented) A digital subscriber line communicating system for communicating between a transmitting side and a receiving side through a communication line, comprising:

a sliding window generating unit for generating a sliding window based on a timing signal representing a periodical noise duration; and

a sliding window transmitting unit for transmitting a modulated symbol according to said sliding window through said communication line to said receiving side;

wherein the number of bits to be transmitted per a carrier signal corresponds to a signal to noise (S/N) ratio for said carrier signal, only the modulated symbols received completely inside of a near end cross-talk duration at the receiving side being used to measure a NEXT duration S/N, and only the inside modulated symbols of the sliding window at the receiving side being used to measure a FEXT duration S/N;

and further comprising a modified sliding window bitmap transmission system for transmitting data symbols in both inside of and outside of said sliding window, and the outside data symbols are transmitted with transmitting capacity determined by a S/N measurement in the a NEXT duration at the receiving side.

Claim 37 (previously presented) A digital subscriber line communicating system for communicating between a transmitting side and a receiving side through a communication line, comprising:

a sliding window generating unit for generating a sliding window based on a timing signal representing a periodical noise duration; and

a sliding window transmitting unit for transmitting a modulated symbol according to said sliding window through said communication line to said receiving side;

wherein the number of bits to be transmitted per a carrier signal corresponds to a signal to noise (S/N) ratio for said carrier signal, only modulated symbols received completely inside of a near end cross-talk duration at the receiving side being used to measure a NEXT duration S/N, and only inside modulated symbols of the sliding window at the receiving side being used to measure a FEXT duration S/N;

further comprising a sliding window bitmap transmission system for transmitting data symbols only inside of said sliding window with transmitting capacity determined by an S/N measurement inside of said sliding window at the receiving side;

wherein a first predetermined number of super frames, each of which is composed of a second predetermined number of modulated symbols and a synchronizing symbol, constitute a single unit, said single unit being synchronized with an integer multiple of one cycle duration of said timing signal, and a synchronizing symbol in said single unit (inverse synchronizing symbol) is made different from other synchronizing symbols in order to maintain said single unit to be synchronized between said central office and said remote terminal, said inverse synchronizing symbol being in an Nth super frame of said super frames and received in a FEXT duration at the receiving side;

wherein said N-th super frame is a 4-th super frame for downstream and a first super frame for upstream, said first predetermined number of super frames is 5, and said second predetermined number of modulated symbols is 68.

Claim 38 (previously presented) A transceiver in a central office connected through a communication line to a remote terminal, said transceiver comprising:

a timing signal generating unit for generating said timing signal representing a periodical noise duration;

a sliding window generating unit, operatively connected to said timing signal generating unit, for generating a downstream sliding window indicating the phase of a noise condition of said remoter terminal; and

a sliding window transmitting unit for transmitting modulated symbols according to said downstream sliding window through said communication line to said remote terminal;

wherein said downstream sliding window is generated in such a way that an inside symbol of said downstream sliding window is received by said remote terminal in a far end cross-talk duration at said remote terminal;

wherein a first cross-talk duration is within a prior half of each cycle of said timing signal, and a second cross-talk duration determined with a near end cross-talk duration at the remote terminal is within a latter half of each cycle of said timing signal,

an inside of said downstream sliding window being formed within said first cross-talk duration;

wherein, during timing recover training between said central office and said remote terminal, an inside symbol of said downstream sliding window is formed by a first kind of signal, and an outside symbol of said downstream sliding window is formed by a second kind of signal, said first kind of signal and said second kind of signal each being obtained by modulating a carrier signal but being different in phase by a predetermined angle.

Claim 39 (new) A digital subscriber line communicating method which performs data communication by utilizing a telephone line as a high-speed data communication line, comprising the step of:

conducting the S/N measurement in which, during training for communication, DMT symbols not completely received inside of a near end cross talk (NEXT) duration or a far end cross talk (FEXT) duration at a receiving side are not used to measure the S/N, DMT symbols received inside of the NEXT duration are used to measure the NEXT duration S/N, and DMT symbols received inside of the FEXT duration are used to measure the FEXT duration S/N.

Claim 40 (new) A digital subscriber line communicating method which performs data communication by utilizing a telephone line as a high-speed data communication line, comprising the steps of:

conducting the S/N measurement in which, during training for communication, DMT symbols not completely received inside of a near end cross talk (NEXT) duration or a far end cross talk (FEXT) duration at a receiving side are not used to measure the S/N, DMT symbols received inside of the NEXT duration are used to measure the NEXT duration S/N, and DMT symbols received inside of the FEXT duration are used to measure the FEXT duration S/N; and

determining the number of bits to be transmitted in accordance with the measured S/N.

Claim 41 (new) An xDSL apparatus comprising a measuring means for conducting an S/N measurement in which, during training for communication, DMT symbols not completely received inside of a near end cross talk (NEXT) duration or a far end cross talk (FEXT) duration at a receiving side are not used to measure the S/N, DMT symbols received inside of the NEXT duration are used to measure the NEXT duration S/N, and DMT symbols received inside of the FEXT duration are used to measure the FEXT duration S/N.

Claim 42 (new) An xDSL apparatus comprising:

a measuring means for conducting an S/N measurement in which during training for communication, DMT symbols not completely received completely inside of a near end cross talk (NEXT) duration or a far end cross talk (FEXT) duration at a receiving side are not used to measure the S/N, DMT symbols received inside of the NEXT duration are used to measure the NEXT duration S/N, and DMT symbols received inside of the FEXT duration are used to measure the FEXT duration S/N; and

a means for determining the number of bits to be transmitted in accordance with the measured S/N.

Claim 43 (new) A digital subscriber line communicating method for transmitting a Sync Symbol for defining the boundary of a Super Frame comprising 69 DMT symbols, through a telephone line, which can be affected by a near end cross-talk (NEXT) or a far end cross-talk (FEXT) from ISDN in the former and the latter halves of a TCM of 400Hz, characterized in that:

five Super Frames form one unit whose duration is made to coincide with an integer multiple of the time duration (2.5 ms) of the TCM of 400Hz and the fourth Sync Symbol is transmitted as an inverted Sync Symbol, to the FEXT duration of a receiver side in order to transmit the boundary of the five Super Frames.

Claim 44 (new) A digital subscriber line communicating method for transmitting a Sync Symbol for defining the boundary of a Super Frame comprising 69 DMT symbols, through a telephone line, which can be affected by a near end cross-talk (NEXT) or a far end cross-talk (FEXT) from ISDN in the former and the latter halves of a TCM of 400Hz, characterized in that:

five Super Frames form one unit whose duration is made to coincide with an integer multiple of the time duration (2.5 ins) of the TCM of 400Hz and the first Sync Symbol is transmitted as an inverted Sync Symbol, to the FEXT duration of a central office in order to inform the central office of the boundary of the five Super Frames.

Claim 45 (new) An xDSL apparatus for transmitting a Sync Symbol for defining the boundary of a Super Frame comprising 69 DMT symbols through a telephone line, which can be affected by a near end cross-talk (NEXT) or a far end cross-talk (FEXT) from ISDN in the former and the latter halves of a TCM of 400Hz, characterized in that:

five Super Frames form one unit whose duration is made to coincide with an integer multiple of the time duration (2.5 ins) of the TCM of 400Hz and the fourth Sync Symbol is transmitted as an inverted Sync Symbol, to the FEXT duration of a receiver side in order to transmit the boundary of the five Super Frames.

Claim 46 (new) An xDSL apparatus for transmitting a Sync Symbol for defining the boundary of a Super Frame comprising 69 DMT symbols through a telephone line, which can be affected by a near end cross-talk (NEXT) or a far end cross-talk (FEXT) from ISDN in the former and the latter halves of a TCM of 400Hz, characterized in that:

five Super Frames form one unit whose duration is made to coincide with an integer multiple of the time duration (2.5 ins) of the TCM of 400Hz and the first Sync Symbol is transmitted as an inverted Sync Symbol, to the FEXT duration of a central office in order to inform the central office of the boundary of the five Super Frames.

Claim 47 (new) A digital subscriber line communicating method which performs data communication by utilizing a telephone line as a high speed data communication line, characterized in that:

during training for starting data communication, a signal for representing a switching of the training sequence is transmitted to a central office in accordance with a timing when a receiving side can receive the switching signal during a far end cross talk (FEXT) duration.

Claim 48 (new) A digital subscriber line communicating method which performs data communication by utilizing a telephone line as a high speed data communication line, characterized in that:

during training for starting data communication, a signal for representing a switching of the training sequence is transmitted to a central office in accordance with a timing when a receiving side can receive the head of the switching signal during a far end cross talk (FEXT) duration.

Claim 49 (new) A digital subscriber line communicating method which performs data communication by utilizing a telephone line as a high speed data communication line, characterized in that:

during training for starting data communication, a symbol for representing a switching of the training sequence is transmitted to a central office in accordance with a timing when a receiving side can receive the head of the switching symbol during a far end cross talk (FEXT) duration.

Claim 50 (new) An xDSL apparatus which performs data communication by utilizing a telephone line as a high speed data communication line, characterized in that:

during training for starting data communication, a signal for representing a switching of the training sequence is transmitted to a central office in accordance with a timing when a receiving side can receive the switching signal during a far end cross talk (FEXT) duration.

Claim 51 (new) An xDSL apparatus which performs data communication by utilizing a telephone line as a high speed data communication line, characterized in that:

during training for starting data communication, a signal for representing a switching of the training sequence is transmitted to a central office in accordance with a timing when a receiving side can receive the head of the switching signal during a far end cross talk (FEXT) duration.

Claim 52 (new) An xDSL apparatus which performs data communication by utilizing a telephone line as a high speed data communication line, characterized in that:

during training for starting data communication, a symbol for representing a switching of the training sequence is transmitted to a central office in accordance with a timing when a receiving side can receive the head of the switching symbol during a far end cross talk (FEXT) duration.

Claim 53 (new) A digital subscriber line communicating method which performs data communication by utilizing a telephone line, which can be affected by a cross talk of ISDN ping pong transmission, as a high speed data communication line, characterized in that:

in a system wherein data transmission is conducted only in a far end cross talk (FEXT) duration, a pilot tone is transmitted as DMT symbols outside the FEXT duration.

Claim 54 (new) A digital subscriber line communicating method which performs data communication by utilizing a telephone line, which can be affected by a cross talk of ISDN ping pong transmission, as a high speed data communication line, characterized in that:

in a system wherein data transmission is conducted only in a far end cross talk (FEXT) duration, a pilot tone is transmitted as DMT symbols inside the NEXT duration.

Claim 55 (new) An xDSL apparatus which performs data communication by utilizing a telephone line, which can be affected by a cross talk of ISDN ping pong transmission, as a high speed

said xDSL apparatus further comprises a step wherein, in a system wherein data transmission is conducted only in a far end cross talk (FEXT) duration, a pilot tone is transmitted as DMT symbols outside the FEXT duration.

Claim 56 (new) An xDSL apparatus which performs data communication by utilizing a telephone line, which can be affected by a cross talk of ISDN ping pong transmission, as a high speed data communication line, characterized in that

said xDSL apparatus further comprises a step wherein, in a system wherein data transmission is conducted only in a far end cross talk (FEXT) duration, a pilot tone is transmitted as DMT symbols inside the NEXT duration.

Claim 57 (new) A digital subscriber line communicating system which performs data communication by utilizing a telephone line, which can be affected by a cross talk of ISDN ping pong transmission, as a high speed data communication line, characterized in that

in a system wherein data transmission is conducted only in a far end cross talk (FEXT) duration, a pilot tone is transmitted as symbols outside the FEXT duration.

Claim 58 (new) An xDSL apparatus which performs data communication by utilizing a telephone line, which can be affected by a cross talk of ISDN ping pong transmission, as a high speed data communication line, characterized in that

said xDSL apparatus further comprises a step wherein, in a system wherein data transmission is conducted only in a far end cross talk (FEXT) duration, a pilot tone is transmitted as symbols outside the

FEXT duration.

Claim 59 (new) A digital subscriber line communicating system which performs data communication by utilizing a telephone line, which can be affected by a cross talk of ISDN ping pong transmission, as a high speed data communication line, characterized in that:

in a system wherein data transmission is conducted only in a far end cross talk (FEXT) duration, a pilot tone is transmitted as symbols outside a sliding window.

Claim 60 (new) An xDSL apparatus which performs data communication by utilizing a telephone line, which can be affected by a cross talk of ISDN ping pong transmission, as a high speed data communication line, characterized in that

said xDSL apparatus further comprises a step wherein, in a system wherein data transmission is conducted only in a far end cross talk (FEXT) duration, a pilot tone is transmitted as symbols outside a sliding window.

Claim 61 (new) A digital subscriber line communicating method which performs data communication by utilizing a telephone line, which can be affected by a cross talk of ISDN ping pong transmission, as a high speed data communication line, wherein 69 DMT symbols form a Super Frame and five Super Frames form one unit whose duration is made to coincide with an integer multiple of 400Hz (2.5 ins) and is transmitted in a DMT symbol of 246 μ s, characterized in that:

when the first DMT symbol is synchronized with the head of 400 Hz,

if a sample value representing the head of an n-th symbol, of 2760 samples in one cycle of 400 Hz is smaller than a sample value representing the head of the symbols completely inside the sample value (a) representing a receiving far end cross talk (FEXT) duration or is larger than the sum of the sample value (a) representing the receiving FEXT duration and a sample value (b) representing a receiving near end cross talk (NEXT) duration, the n-th symbol is defined as the FEXT duration, and

if the sample value representing the head of the n-th symbol of said 2760 samples is not less than the sample value representing the head of the symbols completely inside the sample value (a) representing the receiving FEXT duration and is not more than the sum of the sample value (a) representing the FEXT duration and the sample value (b) representing the receiving NEXT duration, the n-th signal is defined as the NEXT duration.

Claim 62 (new) A digital subscriber line communicating method which performs data communication by utilizing a telephone line, which can be affected by a cross talk of ISDN ping pong transmission, as a high speed data communication line, wherein 69 DMT symbols form a Super Frame and five Super Frames form one unit whose duration is made to coincide with an integer multiple of 400 Hz (2.5 ins) and is transmitted in a single DMT symbol of 246 μ s, characterized in that

when the first DMT symbol is synchronized with the head of 400 Hz, whether the duration on the receiving side, to which the n-th symbol belongs is determined by the following formulas:

on the assumption that:

$$S = (256 * (n-1)) \bmod 2760,$$

if $\{(S < (a-256) \text{ or } (S > (a+b)))\}$ then FEXT duration
if $\{(a-256) \leq S \leq (a+b)\}$ then a near end cross talk (NEXT) duration
wherein "a" is a sample value representing a receiving far end cross talk (FEXT) duration
and b is a sample value representing the receiving NEXT duration.

Claim 63 (new) A digital subscriber line communicating method which performs training for data communication using a DMT symbol, by utilizing a telephone line as a high speed data communication line, characterized in that

a symbol whose 4-value QAM signal point is different by 90 degrees is transmitted as a symbol to inform a phase of TCM 400 Hz to a receiving side.

Claim 64 (new) A digital subscriber line communicating method which performs training for data communication using a DMT symbol, by utilizing a telephone line as a high speed data communication line, characterized in that:

the DMT symbol from the receiving side is demodulated to detect a phase of TCM 400 Hz, using two kinds of signal points whose phases are different by 90 degrees from one another.

Claim 65 (new) A digital subscriber line communicating method which performs training for data communication using a DMT symbol, by utilizing a telephone line as a high speed data

a specific frequency carrier is selected as a DMT symbol for informing a near end cross talk (NEXT) duration and a far end cross talk (FEXT) duration and two signal points of 4-value

QAM signal points whose phases are different by 90 degrees from one another are modulated and transmitted.

Claim 66 (new) A digital subscriber line communicating method which performs training for data communication using a DMT symbol, by utilizing a telephone line as a high speed data communication line, characterized in that

a specific frequency carrier including less TCM cross talk is selected as a DMT symbol for informing a near end cross talk (NEXT) duration and a far end cross talk (FEXT) duration and two signal points of 4—value QAM signal points whose phases are different by 90 degrees from one another are modulated and transmitted.

Claim 67 (new) A digital subscriber line communicating method which performs training for data communication using a DMT symbol, by utilizing a telephone line as a high speed data communication line, characterized in that:

the received DMT symbol is demodulated to discriminate a near end cross talk (NEXT) duration and a far end cross talk (FEXT) duration, using two kinds of signal points whose phases are different by 90 degrees from one another.

Claim 68 (new) An xDSL apparatus comprising a means in which a specific frequency carrier is selected as a DMT symbol for informing a near end cross talk (NEXT) duration and a far end cross talk (FEXT) duration and two signal points of 4-value QAM signal points whose phases are different by 90 degrees from one another are modulated and transmitted.

Claim 69 (new) An xDSL apparatus comprising a means in which a specific frequency carrier including less TCM cross talk is selected as a DMT symbol for informing a near end cross talk (NEXT) duration and a far end cross talk (FEXT) duration and two signal points of 4-value QAM signal points whose phases are different by 90 degrees from one another are modulated and transmitted.

Claim 70 (new) An xDSL apparatus comprising a means in which the received DMT symbol is demodulated to discriminate a near end cross talk (NEXT) duration and a far end cross talk (FEXT) duration, using two kinds of signal points whose phases are different by 90 degrees from one another.

Claim 71 (new) An xDSL system comprising:

a sender means in which a specific frequency carrier is selected as a DMT symbol for informing a near end cross talk (NEXT) duration and a far end cross talk (FEXT) duration and two signal points of 4-value QAM signal points whose phases are different by 90 degrees from one another are modulated and transmitted, and

a receiver means in which the received DMT symbol is demodulated to discriminate the NEXT duration and the FEXT duration, using two kinds of signal points whose phases are different by 90 degrees from one another.